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## (54) PRESSURIZED DISPENSER OF THE COLLAPSIBLE INNER CONTAINER TYPE

(71) We, RHEN BETEILIGUNGS- UND FINANZIERUNGS-AG a Company organised under the laws of Switzerland of Schwarrzhorngasse 170, Stein am Rhein, Switzerland (formerly known as Rhenag AG) do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to containers for holding and delivering liquid and paste products under pressure. Commonly a container of this type comprises a rigid outer container and a flexible inner container, an upper edge of which is attached to the outer container, with a cover placed over and joined to an upper edge of the outer container the cover containing a delivery valve which at least in part projects into the inner container, and with propellant gas in the free space between the outer and the inner container.

Containers of the type described are commonly called pressure or spray cans and will be referred to as such. When the delivery valve of such a can is operated the propellant gas forces the contents of the inner container out through the valve. During this process the inner flexible container is compressed further and further until all the contents are expelled. The inner container then has the shape of a compressed hose or sausage. However, there is always a danger that the inner container will not be compressed equally over its entire length and it can happen that the container becomes pinched together close to the delivery valve end.

Where a constriction is created in this way, the product remaining in the remainder of the inner container cannot be expelled with a resulting loss of valuable product.

The inner container has already been given various shapes to prevent this loss.

A spray can is known which is formed from a rigid outer container with a flexible inner container arranged in it. The inner container has an upper edge by which it is attached to the outer container. Its casing is corrugated like a concertina and has appropriate undulations which run in the circumferential direction. When the delivery valve projecting into the inner container is opened, the over-pressure prevailing between the outer and the inner container becomes effective and presses the latter together in the longitudinal direction in such a way that the walls forming the corrugations move towards each other. The inner container is compressed like a concertina. This compression ends when the outer faces of the walls forming the corrugations rest on one another. The wall thickness of the container and the number of its corrugations or fold-lines thus limits the evacuation process and complete evacuation is not possible, a residual quantity being left behind in the inner container. In addition, the inner container is never compressed only in the direction of its longitudinal axis in this ideal form. It is narrowed radially as well. This is favoured by reductions in the wall thickness at the fold-lines, and these varying wall thicknesses and the relatively high number of corrugations of fold-lines also increase the manufacturing cost. Such an assembly is described in Swiss Patent Specification No. 447,968.

Another spray can is also known which has an inner container with several fold-lines arranged running in the longitudinal direction. In horizontal section these can have the shape of flat troughs or depressions. These fold-lines promote a controlled collapse of the inner container so that it narrows evenly over its whole length. This form of inner container can only be used, however, when its outer circumferential dimensions correspond approximately to the inner circumferential dimensions of the outer container. However, it is sometimes necessary for the inner container to be given a considerably smaller circumferential dimension so that it is still adequately compressed if there is a loss of propellant gas (see West German Patent Specification 2,103,447).

Progressing from this state of the art, it is an object of the invention to construct an inner container of a spray can in such a way that it

can be almost completely evacuated even when it is located in a spray can having a large outer container.

It is also an object to produce an inner container having a high effective useful volume and which is economical both to produce and to assemble.

According to the present invention there is provided a container for holding and delivering liquid and paste products under pressure, comprising a rigid generally cylindrical outer container defining a longitudinal axis and having an upper edge, a flexible inner container also having an upper edge, means joining the two said upper edges together, a valve-bearing cover also joined to the upper edge of the outer container, a delivery valve located in the cover and projecting into the inner container, the free space between the outer and inner containers serving to accommodate propellant gas under pressure, wherein the inner container comprises longitudinally extending wall sections which, in the initially filled condition of the pressurised container, are similarly curved convexly to the outer container about differing axes parallel to the longitudinal axis of the outer container, the curved wall sections alternating with intervening longitudinally extending connecting wall sections which connect between said curved wall sections in the longitudinal direction, the said curved wall sections each being non-uniformly spaced from the outer container around its curve with a maximum spacing generally mid-way between the adjacent connecting sections, and the said curved wall sections bowing inwardly to assume an increasingly concave condition with respect to the outer container as the container is emptied of its product during use.

The pressure exerted by the propellant gas in the space between the inner and outer containers acts on the cross-section of the inner container. With the specific shape according to the invention the rigidity varies over its circumference. In the centre of each curved section the rigidity is at its lowest. Consequently, the inner container will give along the centre of each section and will fold inwards to form a shape having, in the minimum case, three wings. Thus, it folds in a controlled way evenly over its whole length. In the final stage of compression it has the shape of a star having three points (or more than three points where there are more than three sections). Along the centre line or through the centre of the star a hollow channel will remain open, through which the product can rise up to the delivery valve so that an almost complete evacuation of the inner container is guaranteed.

It is essential that the inner container should yield first along the central region of each curved section. To this end the radius R of each curved wall section is greater than the radius of curvature of the regions of wall section connecting the said curved sections. This means that the resistance of the curved section to the pressure acting upon it is always less than the resistance of the connecting wall sections.

Preferably the thickness of the material forming the connecting wall sections is greater than that of the material forming the curved sections. This makes the connecting wall regions still stronger and more rigid than the curved sections so that they further resist compression.

Due to its smooth shape the inner container according to the invention can be produced economically. A flexible material such as plastics sheet or aluminium foil can be used for its construction.

In the preferred embodiment the inner container is made up of three curved sections. However it can be formed from four or more curved sections.

In a further development the connecting wall regions are in the shape of protuberances having a rib extending radially externally therefrom. The ribs press against the inside face of the outer container when the inner container is full, due to the internal pressure exerted by the contents, friction between the ribs and the inside face of the outer container prevent the inner container from slipping downwards inside the outer container, due to the weight of the contents.

The invention will now be described, using as examples the forms of construction shown in the accompanying drawings to which reference will now be made.

Fig. 1 is a longitudinal section through one form of construction of pressure can embodying the invention,

Fig. 2 is a cross-section along the section line 2—2 in Fig. 1,

Fig. 3 is a side view of the inner container,

Fig. 4 is a cross-section along the section line 4—4 in Fig. 3,

Fig. 5 is a cross-section through the inner and outer containers at the start of evacuation,

Fig. 6 is a cross-section through the inner and outer containers during evacuation of the inner container,

Fig. 7 is a section through the inner and outer containers after evacuation of the inner container,

Fig. 8 is a side view of another form of construction of an inner container,

Fig. 9 is a cross-section along the section line 9—9 in Fig. 8, showing the outer container at the same time, and

Fig. 10 is a plan view of the form of construction shown in Fig. 9, showing both inner and outer containers.

Figs. 1 to 4 show an outer container 12 with a base 14, with a stopper 16 sealing off a filling opening in the base, a dome-shaped top 18 which is connected to the casing of the outer container via a lower flanged edge 20, with an upper flanged edge 22 in which a

valve-bearing cover 24 is suspended, with a delivery valve 26 secured therein. The inner container 28 is open at its upper end, where it has a rim 30, and is suspended by and clamped in this rim 30 in the flanged edge 22. Between the inner and the outer containers 28 and 12 respectively there is a gas space 32. The inner container 28 consists of three arcuate sections 34 and joining regions 36 which connect the sections 34 together. In Fig. 4 the radius of such arcuate section 34 is denoted by R while the smaller radius of curvature of each joining region 36 is designated *r*.

Figs. 1, 2 and 4 show how the thickness of the regions 36 is greater than the thickness of the arcuate sections 34.

Fig. 5 shows the shape of the inner container when filling has been completed. The arrows indicate the main effective direction of the pressure which is exerted by the propellant gas in the gas space 32. Due to the varying resistance of the inner container to the external pressure acting on it, the effect of this is first seen in the central regions of the arcuate sections 34. When the valve 26 is initially opened the inner container is compressed towards the shape shown in Fig. 6 and as it empties it begins to conform more and more towards the shape shown in Fig. 7 in which only a central through-channel 42 still remains open. Around this the inner container assumes the shape of a three-pointed star 44 over its whole length. In this way the contents of the inner container can all emerge via the through-channel 42.

With the form of construction shown in Figs. 8 to 10 the regions 36 are replaced by protuberances 38 having radially outer ribs 40 which make contact with the inner surface of the outer container 12. The friction between the ribs and the inside surface of the outer container 12 prevents the inner container from slipping down in the outer container 12 due to the weight of the contents. For the rest, evacuation takes place in the same way as was described with reference to Figs. 1 to 7.

It will be seen that the friction force between the ribs 40 and the inside surface of the outer container 12 is sufficient to at least partially support the weight on the inner container 28 when the latter is full. This reduces the strain on the joint which supports the inner container and which is formed by trapping the upper rim of the inner container between the domed end closure member 18 and the circular valve bearing cover 24.

WHAT WE CLAIM IS:—

1. A container for holding and delivering liquid and paste products under pressure, comprising a rigid generally cylindrical outer container defining a longitudinal axis and having an upper edge, a flexible inner container also having an upper edge, means joining the two said upper edges together, a valve-bearing cover also joined to the upper edge of the outer container, a delivery valve located in the cover and projecting into the inner container, the free space between the outer and inner containers serving to accommodate propellant gas under pressure, wherein the inner container comprises longitudinally extending wall sections which, in the initially filled condition of the pressurised container, are similarly curved convexly to the outer container about differing axes parallel to the lonigtudinal axis of the outer container, the curved wall sections alternating with intervening longitudinally extending connecting wall sections which connect between said curved wall sections in the longitudinal direction, the said curved wall sections each being non-uniformly spaced from the outer container around its curve with a maximum spacing generally mid-way between the adjacent connecting sections, and the said curved wall sections bowing inwardly to assume an increasingly concave condition with respect to the outer container as the container is emptied of its product during use.

2. A container as claimed in claim 1 wherein each curved wall section has a radius of curvature (R) and each connecting wall section has a radius of curvature (*r*), and (R) is greater than (*r*).

3. A container as claimed in claim 1 wherein the strength of the material forming the connecting wall sections is greater than the strength of the material forming the curved wall sections.

4. A container as claimed in claim 1 wherein the connecting wall sections comprise protuberances having radial outwardly directed ribs for engaging the inside surface of the outer container.

5. A container as claimed in claim 4 in which the friction force between the ribs and the inside surface of the outer container is sufficient to at least partially support the weight of the inner container when the latter is full.

6. Containers for holding and delivering liquid and paste products under pressure constructed and arranged substantially as herein described with reference to and as illustrated in the accompanying drawings.

KEITH W. NASH & CO.,
Chartered Patent Agents,
22 Hills Road,
Cambridge CB2 1JP,
Agent for the Applicants.

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1601424 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

FIG. 1

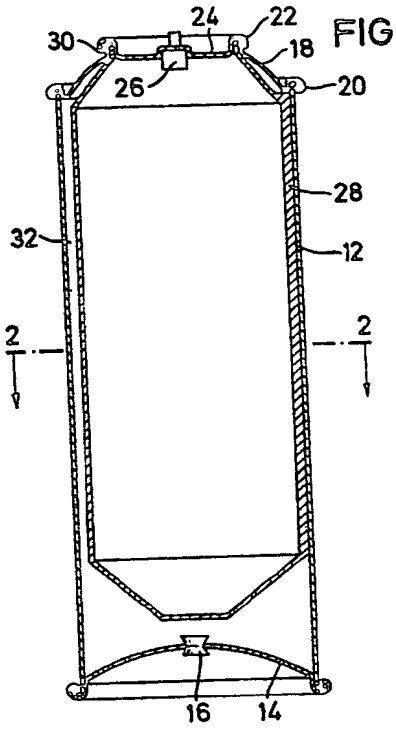



FIG. 3

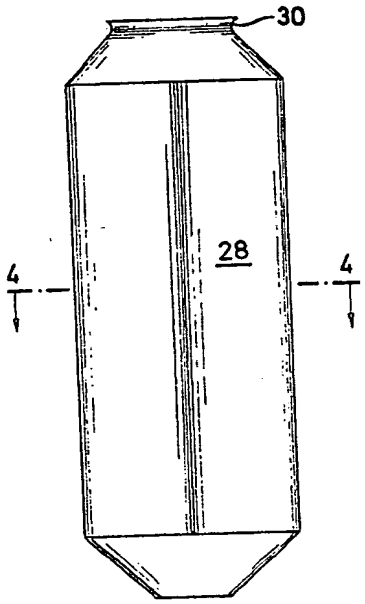



FIG. 2

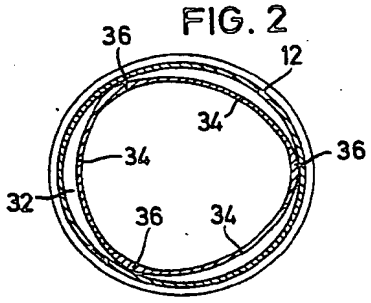
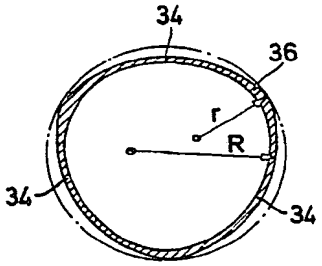



FIG. 4



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Sheet 2

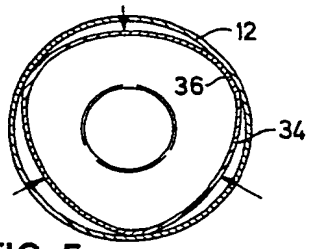


FIG. 5

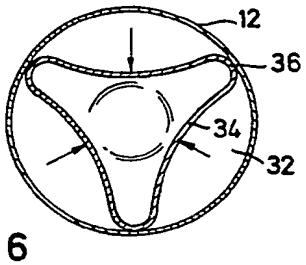


FIG. 6

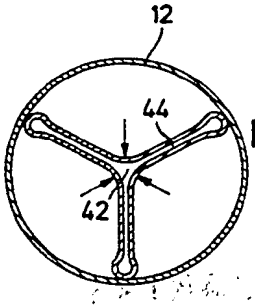


FIG. 7

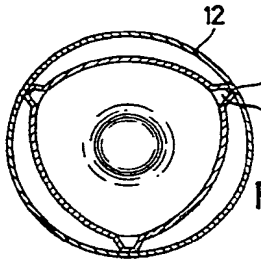


FIG. 9

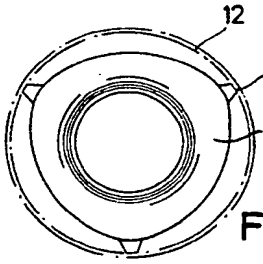


FIG. 10

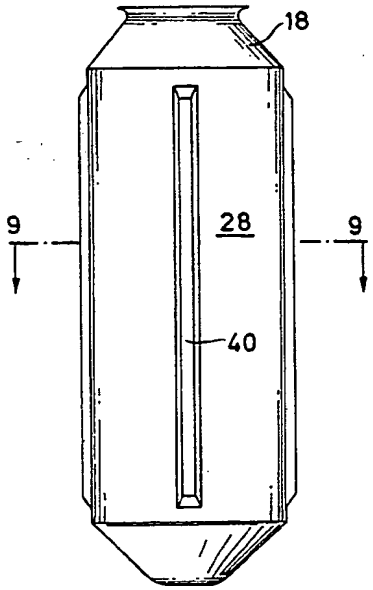


FIG. 8